

North Carolina Division of Air Quality

Study of Costs and Benefits of Reducing Emissions of Oxides of Nitrogen, Particulate Matter, and Greenhouse Gases from Motor Vehicles

Interim Report to the Environmental Review Commission and the Legislative Commission on Global Climate Change

January 15, 2007

The Requirement: Excerpted from SESSION LAW 2006-248, HOUSE BILL 1723

PART XLIII. DIVISION OF AIR QUALITY STUDY OF COSTS AND BENEFITS OF REDUCING EMISSIONS OF OXIDES OF NITROGEN, PARTICULATE MATTER, AND GREENHOUSE GASES FROM MOTOR VEHICLES. (S.B, 1006 – Clodfelter)

SECTION 43. The Division of Air Quality of the Department of Environment and Natural Resources shall study the costs and benefits of reducing emissions of oxides of nitrogen, particulate matter, and greenhouse gases from motor vehicles in this State. In particular, the Division shall evaluate the desirability and air quality benefits of adopting motor vehicle emissions standards adopted in other states. The Division of Air Quality shall submit an interim report on its findings and recommendations, including any legislative proposals, no later than January 15, 2007 and shall submit a final report no later than April 1, 2007 to the Environmental Review Commission and the Legislative Commission on Global Climate Change.

Purpose

The objective of this report is to summarize the estimated emissions benefits of adopting the California Low-Emission Vehicle II (CA LEV-II) standard in North Carolina (NC). The emissions benefits analysis includes an examination of nitrogen oxides (NO_x), volatile organic carbons (VOCs), fine particles (PM_{2.5}) and carbon dioxide (CO₂). Using air quality modeling sensitivities recently conducted by the North Carolina Division of Air Quality (NCDAQ), potential ozone benefits were also estimated. Additional data was collected and analyzed to better understand the costs associated with implementing a CA LEV-II program in North Carolina.

Background

The United States Environmental Protection Agency (USEPA) has adopted national motor vehicle and fuel standards which include the Tier 2 vehicle and gasoline standard (phase-in began in 2004), and the heavy-duty diesel vehicle and fuel standard (phase-in begins in 2006 with the release of the model year 2007 heavy-duty diesel vehicles and low sulfur diesel fuel).

Beyond the federal standards, North Carolina has expanded its Inspection and Maintenance (I/M) program, which covers 48 of the State's 100 counties, to ensure that vehicle emission controls are properly working.

The federal Clean Air Act (CAA) provides the framework for regulating emissions from on-road mobile sources. The CAA set the first federal vehicle emission standards. However, because California already had vehicle emission standards when this occurred, the CAA authorized California (and only California) to continue setting its own vehicle emission standards. Therefore all new vehicles sold in the United States (U.S.) are subject to emission standards set by either the federal government or the State of California. Other states have the option to adopt the California vehicle emission standards in lieu of the federal standards. This authority was granted under Section 177 of the CAA. Section 177 also guarantees the automakers that they will not have to meet more than two regulatory regimes by explicitly prohibiting any requirements that result in a "third vehicle".

Overview of Federal Tier 2 and California LEV-II Programs

Federal Tier 2 vehicle and gasoline standards and the CA LEV-II program were each effective with model year 2004 vehicles. Both regulations set emission standards for light-duty vehicles such as passenger cars, trucks, and sport utility vehicles. Both programs are phased in over several years and become progressively more stringent providing significant emission reductions from evaporative and exhaust motor vehicle activity. The auto manufacturers have flexibility in how they meet the annual fleet average emissions standards. Tier 2 and CA LEV-II programs have the following differences:

- Federal Tier 2 program requires all light-duty fleet averages to meet the NO_x standard of 0.07 grams per mile phased-in between years 2004 and 2009. CA LEV-II fleet average standards are based on non-methane organic gases (NMOG), also referred to as hydrocarbons (HC) or VOCs.
- CA LEV-II program requires a portion of the light-duty fleet to be “zero-emission vehicles” (ZEVs) which originally mandated the electric ZEVs. This requirement has been changed to allow partial credit for vehicles with advanced technologies and fall in the categories of Partial ZEVs (PZEVs) or advance technology partial ZEVs (AT-PZEVs).
- The evaporative requirements of the CA LEV-II standard appear to be more stringent than the Tier 2 standard, however the Tier 2 evaporative standard provides for evaporative system durability which USEPA indicates make the Tier 2 evaporative requirements identical to that of the CA LEV-II requirements. Additionally, in February 2006, the USEPA proposed rules that codify the approach that manufacturers are already taking for 50-state evaporative systems. The proposal requires implementation of the “California equivalent” evaporative emission standards in 2009 for lighter vehicles and 2010 for the heavier vehicles.

On-Road Mobile Source Emissions – NO_x and VOC

The NCDAQ conducted a technical modeling analysis study in 2006 to begin to understand the emissions benefits of adopting CA LEV-II in North Carolina. The emissions benefits analysis included a comparison of statewide on-road mobile source NO_x and VOC emissions resulting from the current federal level of control (Tier 2), and from the CA LEV-II level of control. It should be noted that the emission differences were calculated in context of the entire on-road mobile source emissions inventory. This method for comparison enabled the NCDAQ to apply the knowledge gathered in emissions/air quality modeling studies to assess the air quality (ozone) benefits that might result from the CA LEV-II emissions benefits. The details of the technical modeling study including the approach, methods and data used in estimating the benefits are described in the attached Technical Support Document “*Analysis of the California Low Emission Vehicle II Standards in NC.*” Also attached is the power point presentation given by Brock M. Nicholson, P.E., Deputy Director of the NCDAQ to the Environmental Review Commission (ERC) on May 3, 2006.

As can be seen in Table 1, the statewide NO_x and VOC emissions from adopting a CA LEV-II program are lower relative to the Federal Tier 2 level of control. CA LEV-II was assumed to begin in NC in the year 2010 in this analysis. Emissions were estimated for the years 2010, 2020 and 2030. As CA LEV-II vehicles make up a more significant portion of the overall vehicle fleet with time, the CA LEV-II standards show an increasing emissions benefit (i.e., on a percentage basis) over time relative to the Tier 2 level of control.

Table 1. CA LEV-II Reductions Compared to Federal Tier 2: Entire Fleet

	2010	2020	2030
NOx	0.1%	4%	10%
VOC	0.1%	3%	6%

Figure 1 below presents the North Carolina statewide on-road mobile source NOx emissions inventory with a Tier 2 control program for years 2004, 2010, 2020, and 2030 (blue line), and also with a CA LEV-II control program for years 2010, 2020, and 2030 (magenta line). Figure 2 is a similar graph for VOC emissions. (It should be noted that the NOx and VOC emission estimates with a Tier 2 control program, assume there are no CA LEV-II compliant vehicles in North Carolina already. While NCDAQ does not have any official data, informal surveys have shown there are North Carolinians already driving CA LEV-II compliant vehicles. Therefore, the emission benefits of the CA LEV-II program shown in Table 1 and Figures 1 and 2 are likely over-estimated.)

Also noteworthy, these figures illustrate the significant reductions in on-road mobile emissions, regardless of the control program, expected over time in North Carolina. These reductions will occur despite significant estimated increases in VMT (see Figure 3).

Figure 1. Estimated NOx Emissions – Federal Tier2 vs. CA LEV-II

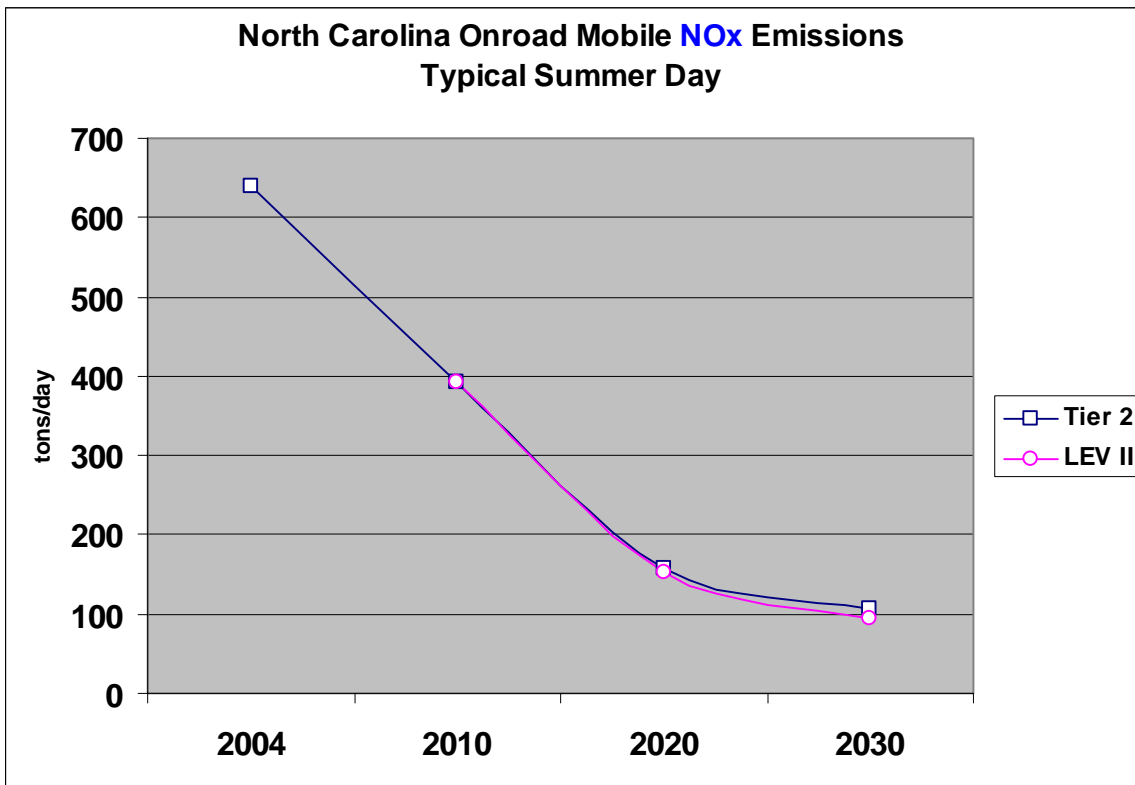


Figure 2. Estimated VOC Emissions – Federal Tier2 vs. CA LEV-II

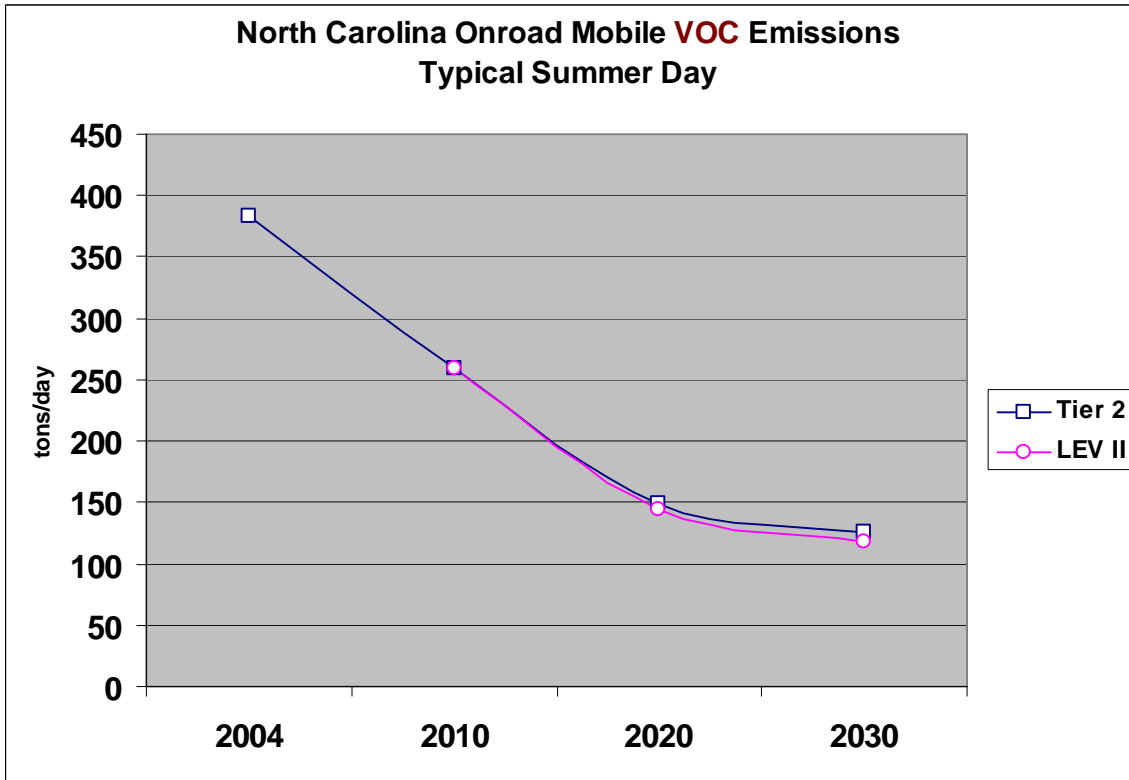
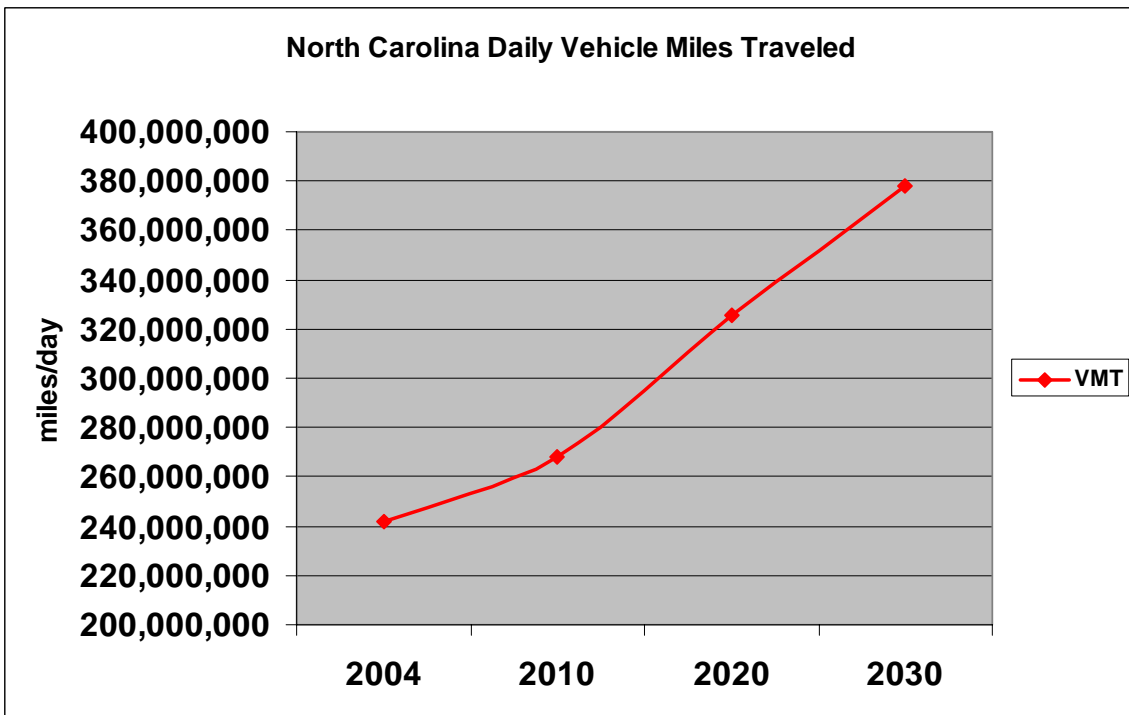


Figure 3. Estimated Vehicle Miles Traveled



Particulate Matter

Particle pollution (also known as "particulate matter") is a mixture of tiny solids and liquid droplets suspended in air. Airborne particles are the main ingredient in haze, smoke and airborne dust. Particles less than 2.5 micrometers in diameter are called "fine" particles or "PM2.5", and are of special concern because they can penetrate deeply into the lungs.

Potential particulate matter emissions impacts were not specifically evaluated in the NCDAQ modeling study for several reasons. First, based on North Carolina's 2002 PM2.5 emissions inventory, on-road mobile sources only contribute approximately 5% to the total statewide PM2.5 emissions inventory. Secondly, a study of North Carolina's vehicle registration database suggests only 0.3% of the light duty vehicles registered in NC are diesels. This is important because the PM2.5 vehicle standards are for all practical purposes only relevant to diesels, since gas vehicles easily meet the standards. Therefore the most relevant impact of adopting the CA LEV-II program might be on the sales of diesel vehicles themselves. However, major vehicle manufacturers have recently indicated their intention to develop light duty diesel vehicles that meet the CA LEV-II requirements. Overall, the impacts to particulate matter emissions would be negligible if NC adopts the CA LEV-II program.

Greenhouse Gases – Status of Pavely

The Pavley requirements of the CA LEV-II standards are designed specifically to reduce greenhouse gases (GHG) from light duty vehicles. Named after California Assembly woman Fran Pavely, it became California law in 2002, and pending a waiver from USEPA, takes effect in model year 2009. If granted the Pavely waiver from USEPA, all states that have adopted the CA LEV-II standards would automatically be subject to the Pavely component of the standard. If USEPA does not grant the waiver to California, the decision may be challenged in the Federal Court of Appeals in Washington DC.

NCDAQ is aware of several pending court cases involving the CA LEV-II standards and specifically the Pavely requirements in California, Vermont and Rhode Island. The Pavely requirements must survive the lawsuits and get the waiver from USEPA to be "available" to North Carolina. These legal issues are discussed below.

In California, auto industry filed a lawsuit under the California Environmental Quality Act (CEQA) challenging the Pavely requirements directly. The plaintiffs challenges are procedural, although should the plaintiff prevail, the rules could be nullified in California, which could undercut the rules in all other states that have adopted them. Recently, the federal district court judge threw out two of the auto industry's five claims against the Pavely regulations. No decisions have been issued on the other three claims.

In Maine, the Alliance of Automobile Manufacturers filed a lawsuit against the Maine Board of Environmental Protection asking that Maine's rules be stayed. The court rejected the claim on two grounds: First, Maine state law does not allow a court to issue a stay in a challenge to a rulemaking proceeding. Second, even if the court could issue a

stay, the plaintiff had not demonstrated that it would suffer irreparable injury, because: 1) the rules cannot be implemented until a waiver is issued by USEPA and 2) the rules do not go into effect until 2009 anyway. Later, the case was dismissed without prejudice (meaning they can file again within one year) because they filed under the wrong administrative provisions.

In Vermont, the auto industry filed a lawsuit in federal court in November 2005. Since then, the state moved the court to dismiss the case claiming the case was not ripe. On November 30, 2006 the District Court denied the state's motion to dismiss finding that the "purely legal questions raised in this lawsuit are as well determined now as later" despite the uncertainty as to whether a determination will even be necessary given the pending EPA waiver.

Finally, in Rhode Island, the Association of International Automobile Manufacturers filed suit on February 13, 2006 in federal district court asking the court for a declaratory judgment that the Rhode Island regulations violate federal law and a preliminary injunction enjoining Rhode Island from implementing or enforcing the regulation. They also claimed that because California has not obtained a waiver for Pavely, the Clean Air Act expressly prohibits the Rhode Island from adopting and enforcing the regulations. On April 6, 2006 the state filed a motion to dismiss claiming the case was not ripe for judicial review. The Court has not ruled on this motion.

Greenhouse Gases – Potential Emissions Benefits

The GHG emissions addressed by Pavely focus mostly on carbon dioxide (CO₂), but also include methane (CH₄), nitrous oxide (N₂O), and hydrofluorocarbon (HFC) 134a reductions as well. The purpose of the Pavely requirement is to "achieve the maximum feasible and cost effective reduction in GHG emissions from motor vehicles." The standard will require that tailpipe GHG emissions from new vehicles be reduced by 22 percent by the 2012 model year and 30 percent by the 2016 model year.

California and other opt-in states expect that automobile manufacturers will apply technological improvements to meet the Pavley requirements. Specific measures identified include discrete variable valve lift, dual cam phasing, turbo charging with engine downsizing, automated manual transmissions and cam-less valve actuation.

Costs of Vehicles

The initial purchase price of a new vehicle could increase if North Carolina adopts California's vehicle emissions standards. However, these advanced vehicles, especially those meeting the Pavely requirement, are likely to be more fuel efficient, producing savings to the consumer in fuel costs. The anticipated costs have been studied by several organizations including California's Air Resources Board (CARB). These cost ranges are summarized below.

The State of Oregon recently estimated that the CA LEV-II program would increase average vehicle cost \$115 to \$271. These estimates – based on a CARB Staff report

(<http://www.arb.ca.gov/regact/zev2003/isor.pdf>) - were based on the incremental costs of ZEVs, PZEVs and AT-PZEVs in 2012.

The average fleetwide incremental costs associated with the Pavley requirement over the 2009 to 2016 phase-in period, as estimated by CARB, are as high as \$1,000 per vehicle as shown in Table 2 below. CARB also found this initial increase in purchase price to be more than offset by reduced operating costs. Using the average increase in vehicle prices associated with the fully phased-in regulation (2016), and an assumed fuel price of \$1.74 per gallon, CARB calculated that the increased vehicle payment minus the reduction in operating cost would result in a monthly savings of about \$3.50 to \$7.00. At today's higher fuel prices, the monthly savings increase.

Table 2. Potential Vehicle Cost Increase due to Pavley

Tier	Year	Average cost of control	
		PC/LDT1 (Passenger cars and small trucks/SUVs)	LDT2 (Large trucks/SUVs)
Near-term	2009	\$17	\$36
	2010	\$58	\$85
	2011	\$230	\$176
	2012	\$367	\$277
Mid-term	2013	\$504	\$434
	2014	\$609	\$581
	2015	\$836	\$804
	2016	\$1,064	\$1,029

(from: <http://www.arb.ca.gov/regact/grnhsgas/fsor.pdf>, pg 11)

California's Pavley emissions standards are required by law to achieve maximum feasible and cost effective GHG emissions reductions without reducing vehicle weight or banning the sale of any vehicle category such as sport utility vehicles or light duty trucks. Therefore, the estimated costs represent the cost of applying additional technology to the kinds of vehicles known today to achieve emission reductions.

During California's rulemaking process, the auto industry commented that the Pavley requirement of CA LEV-II standard would not produce an overall savings to consumers. The industry's position was based on a study by Sierra Research, which concluded that the average per-vehicle cost of technology required to comply with Pavley was \$3,000 per vehicle. The report also concluded the lifetime gasoline savings would average about 1,000 gallons. CARB's response to these comments was that Sierra's research rejected promising and cost-effective emerging engine technologies as elements of a GHG regulatory compliance strategy. CARB also noted the industry assumed the use of expensive aluminum body structures and assigned higher estimated costs for vehicle components than CARB thought was appropriate. (see <http://www.arb.ca.gov/regact/grnhsgas/fsor.pdf>, pg 168)

Conclusions

The CA LEV-II program (assuming statewide implementation in 2010) could provide NOx reductions on the order of 0.1% in 2010, 4% in 2020 and 10% in 2030 and VOC reductions of 0.1% in 2010, 3% in 2020 and 6% in 2030 as compared to the Federal Tier 2 program already in place. It should be noted that in 2030, the estimated 10% on-road mobile NOx reduction is equivalent to only 10 tons/day of NOx reduced statewide. This is because of the overall on-road mobile NOx emissions are significantly lower by that time due primarily to the Federal Tier 2 program. NCDAQ has estimated this additional level of NOx reduction, due to CA LEV-II in these future years, will not significantly impact North Carolina's ability to attain the National Ambient Air Quality Standard for 8-hr ozone. The CA LEV-II program would have an insignificant impact on particulate matter emissions from vehicles. Greenhouse gas emissions from light duty vehicles could be reduced by an estimated 22 percent by the 2012 model year and 30 percent by the 2016 model year if Paveley survives several lawsuits and if California is granted a waiver from USEPA.

Costs associated with the CA LEV-II program vary depending on how the program is structured. Increased costs from \$115 to \$271 per vehicle have been estimated for CA LEV-II vehicles. If Paveley becomes part of the program, cost increases could be as high as an additional \$1,000 per vehicle. Additionally, NCDAQ has estimated that moderate staffing implications could result from enforcement of CA LEV-II and from the impact to tasks such as transportation conformity, SIP modeling and emission inventories.